

【CLAIMS】

【Claim 1】 A plasma rapid thermal process apparatus comprising a chamber having a supply port and an exhaust port provided at both ends thereof, with a wafer being mounted in the chamber, a thermal source provided in the chamber and including a plurality of lamps for heating the wafer, a gas supply module for supplying process gas, a discharge tube for plasmalizing the process gas supplied from the gas supply module, and a microwave supply apparatus for supplying microwaves to the discharge tube,

wherein the supply port supplies atomic radicals to the chamber, the radicals being formed by the plasmalization of the process gas in the discharge tube, and

wherein the supply port includes:

an inner tube having one end which is opened and connected to the discharge tube and the other end which is closed, the diameter of a closed portion of the other end being smaller than those of other portions of the other end, and a first spray hole being formed around a side wall of the closed portion; and

an outer tube having one end which is opened such that the closed portion of the inner tube is inserted in the one end, and the other end at which a plurality of second spray holes is formed, the other end of the outer tube being spaced apart by a predetermined interval from the other closed end of the inner tube.

【Claim 2】 The plasma rapid thermal process apparatus as set forth in claim 1, wherein the supply port and the exhaust port are arranged at side walls of the chamber, the inside of the chamber is symmetrical on the basis of a virtual line connecting the supply port and the exhaust port, and the bottom of the chamber is formed in parallel with the wafer.

【Claim 3】 The plasma rapid thermal process apparatus as set forth in claim 1, wherein a heating apparatus is arranged around the supply port.

【Claim 4】 The plasma rapid thermal process apparatus as set forth in claim 1, wherein the inner and outer tubes of the supply port are made of quartz, Teflon, alumina, aluminum 6061, ST 304, or Hastelloy C-22, or inner surfaces of the inner and outer tubes are coated with Teflon.

【Claim 5】 The plasma rapid thermal process apparatus as set forth in claim 1, wherein the length of the supply port is greater than the thickness of the side wall of the chamber and is less than 100 mm.

【Claim 6】 The plasma rapid thermal process apparatus as set forth in claim 1, wherein, the inner diameter of the supply port is 15 to 25 mm.

【Claim 7】 The plasma rapid thermal process apparatus as set forth in claim 1, wherein at least two supply ports and at least two exhaust ports are oppositely arranged in a one-to-one correspondence in the chamber, and at least one supply port is connected to the plasma supply apparatus.

【Claim 8】 The plasma rapid thermal process apparatus as set forth in claim 1, wherein an exhaust plate on which a cooling water path is formed is arranged on a side wall opposite to the side wall on which the supply port is provided, a wafer transfer port and the exhaust port being arranged at the exhaust plate 180.

【Claim 9】 The plasma rapid thermal process apparatus as set forth in claim 1, wherein the lamps of the thermal source are provided to emit light in a downward direction of the lamps and the supply port is arranged such that the process gas in the radical state is sprayed in parallel with the wafer within the chamber, and the lamps and the supply port are arranged such that a radiation region of light emitted from the lamps and a spray region of the process gas coincide with each other above the wafer.

【Claim 10】 The plasma rapid thermal process apparatus as set forth in claim 1,

wherein a discharge pressure control valve and a vacuum pump are arranged at the exhaust port.

5 **【Claim 11】** The plasma rapid thermal process apparatus as set forth in claim 1, wherein a spray angle of the supply port is formed such that the spray region of atomic radicals supplied through the supply port covers the entire wafer.